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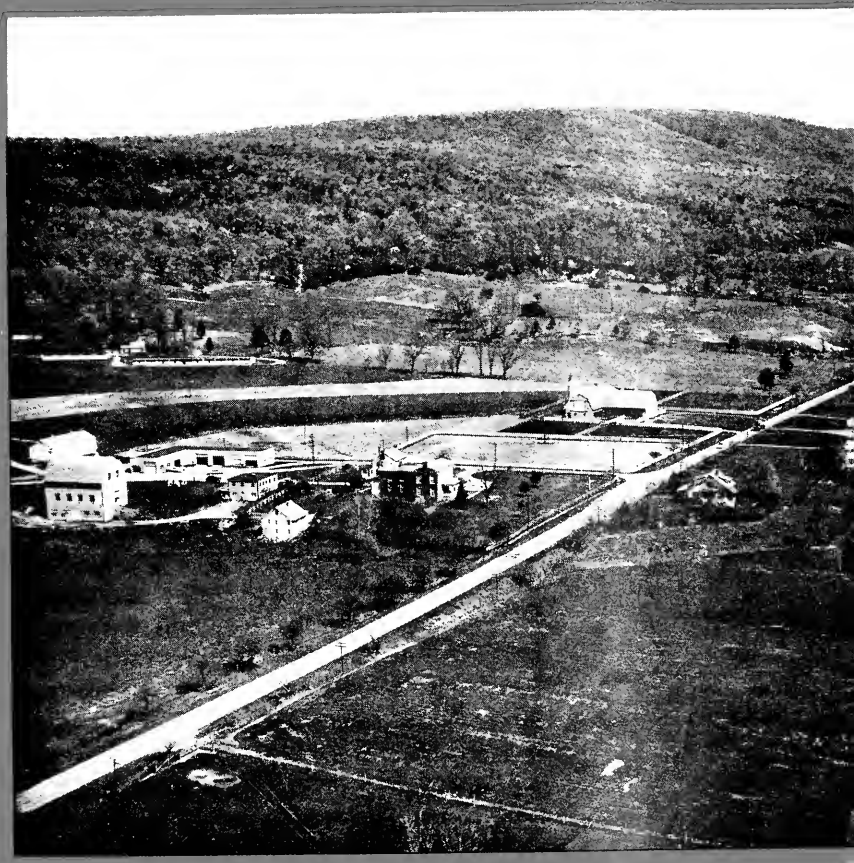

JUNE 1964
BULLETIN 494

AGRICULTURAL EXPERIMENT STATION
WEST VIRGINIA UNIVERSITY

BULLETIN 494 JUNE 1964

Science

Serves your farm and home

Annual Report of A. H. VanLandingham, Director, West Virginia University Agricultural Experiment Station

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Science Serves Your Farm and Home will be sent free to any resident of West Virginia in response to a written request to the Director, Agricultural Experiment Station, West Virginia University, Morgantown, West Virginia 26506.

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On The Calendar...

JULY

29-31 West Virginia Poultry Convention, Moorefield

AUGUST

18-21 State Dairy Show, Jackson's Mill
24-29 West Virginia State Fair, Lewisburg

SEPTEMBER

3-4 State Holstein Annual Meeting and Sale, Lewisburg
11-12 Registration, First Semester, WVU, Morgantown
24-26 State Vo-Ag Judging Contests, Morgantown

——on the cover

Reymann Memorial Farms, a substation of the University's Agricultural Experiment Station, situated on Route 259 approximately two miles north of Wardensville, were a gift to the State of West Virginia in 1917 by the Anton Reymann family of Wheeling in memory of Lawrence A. Reymann. Investigations dealing with beef cattle, sheep, poultry, and crop production are conducted on the farms. Projects include research in agronomy and genetics, animal science, agricultural engineering, and agricultural economics.

The Editors

VETERINARY RESEARCH

New Station Test Will Aid in Accurate Diagnosis and Control of Infectious Synovitis

Kirklyn M. Kerr, Research Associate

FIGURE 1. The infectious synovitis test antigen is grown in specialized artificial medium in an incubator.

INFECTIOUS SYNOVITIS in poultry was discovered and described in 1954 by Dr. N. O. Olson, Station veterinarian. This name was given the disease because of the inflammation it produced around the joints and tendons and in the bursal membrane located over the keel. A pleuropneumonia-like organism (PPLO), *Mycoplasma synoviae*, causes the disease.

Broilers and replacement flocks are reported to be most often affected. Signs of the disease are droopiness, leg weakness, pale combs, swollen hock joints, swollen foot pads, breast blisters, emaciation, and dehydration. Many of these signs can be seen only in the more severely affected birds. Morbidity usually is 20 to 30 per cent in natural outbreaks, and mortality is about 10 per cent.

The control and treatment of infectious synovitis in flocks has been accomplished by culling the severely infected birds and by including aureomycin in the feed. Recently, a new agglutination test antigen was developed to aid in the accurate diagnosis and control of the disease. This antigen shows extreme promise as an economical and efficient agent.

The preparation of the agglutination test antigen involves extensive and controlled laboratory techniques. The *Mycoplasma synoviae* must first be grown in large quantities on artificial medium. To meet this requirement, a specialized PPLO antigen medium was modified and adapted for use with *Mycoplasma synoviae*.

The antigen must then be removed from the artificial growth medium by high-speed centrifugation and washed several times with buffered saline. After washing, standardization must be done to insure the production of antigens with a consistent concentration. The spectrophotometer is used for this purpose in conjunction with McFarland's Nephelometer Tubes.

Finally, the antigen is stained with a 1 per cent alcoholic solution of basic fuchsin or rose bengal—other stains have failed to give comparable results. The agglutination test is then run using the prepared antigen. A flat glass plate is cleaned and used as a surface for the test. A light source behind the plate illuminates the test for accurate reading.

The actual agglutination test for infectious synovitis is conducted by applying one drop of serum from a

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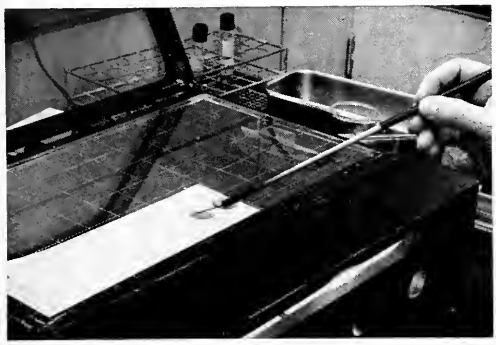

FIGURE 2. A researcher mixing small quantities of chicken serum and the infectious synovitis antigen in a test plate.

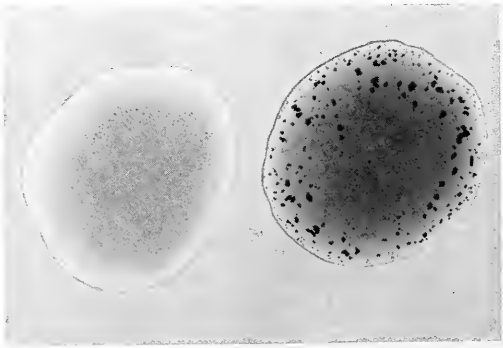

FIGURE 3. The agglutination reaction occurs within 3 minutes (left, negative reaction—right, positive agglutination).

Modern Genetics

Homer Patrick, Agricultural Biochemist

THE early scientists and husbandrymen observed that offspring resembled the parents.

In ancient times it was generally believed that species were fixed and immutable, a concept which persisted well into the nineteenth century. Following the publications of Darwin on the theory of evolution, the modern concepts of the origin of the species were developed. This led to the development of the science of genetics. Thus, it soon became apparent that the most important property of living organisms was their ability to produce offspring having the general characteristics of their parents. It is this property which has led to the existence and maintenance of life on the earth. Studies on cell reproduction have resulted in the development of the field of study known as genetics or breeding. The geneticist received the basic inheritance theory in 1865 from the early work of Mendel, an Austrian monk.

In 1902, William Bateson reported that Mendel's laws govern hereditary transmission in animals as well as in the plant kingdom. Early studies soon showed that "something" was received from the male that united with "something" from the female to form a new individual having characteristics of both parents. The "something" was later found to be chromosomes which were located in the nucleus of the male and female reproductive cell. Each specie has a designated number of chromosomes, which contains the specific units of heredity, called the gene.

The early geneticist spent much time identifying the different genes and their respective chromosomes. This involved the Mendelian law of inheritance. Soon the geneticist observed (offspring) individuals which were different from their parents; not only were these individuals different, they also perpetuated the difference in their offspring. This led to the theory of mutations which developed into the present ideas involving structure of the gene.

The geneticist made many breeding crosses and soon developed locations or positions of genes on chromosomes. Also, complex or multiple genes, in which some segments were dominant or recessive, were visualized or located. This initiated the desire to develop means to produce genetic changes which would result in offspring being produced which would exhibit or display more desirable characteristics than either parent.

The biochemist has been studying the chemical composition of the cock sperm. The nucleus of the sperm was isolated and found to be composed of a biochemical filament called deoxyribonucleic acid (DNA). Each chromosome was found to be a DNA filament or thread. Contained in this filament was a long sequential message written as a cryptogram in the language of a four-letter alphabet. The four-letters of the alphabet are the four different organic compounds which are linked together to form the DNA. The formation of each new cell involves the translation of the cryptogram into series of instruction for the synthesis of biochemical structures that control the continual processes of life. The key to the translation is the genetic code which, according to findings of the biochemists, biophysicists and microbiologists, is carried on by the strands of DNA.

After establishing that DNA carried the genetic code the biochemist made plans for bringing about rearrangement.

Since this could be obtained by ionization or ionic exchange the atomic scientist proposed the use of atomic energy such as gamma rays to supply the energy required to change the DNA structures. Breeding animals and reproductive cells were subjected to gamma rays and the offspring used in breeding studies. Also, radioactive isotopes were used to tag the DNA.

West Virginia University Agricultural Experiment Station is using gamma rays to produce changes in the DNA genetic filaments in turkeys and chickens, and radioactive elements such as Phosphorus^{32}, Arsenic^{76} and Selenium^{75} are being used to determine when and how the DNA is being manufactured in the reproductive tract. The gamma rays speed up the incidence of genetic changes, and the knowledge gained by usage of radioactive isotopes is providing information on the best time to administer the gamma rays.

Hence we can see that DNA, gamma rays, and radioactive isotopes are the tools of the modern geneticist. When enough progress is made to determine the DNA structure of a gene, it may be possible to use biochemistry to make planned genetic changes.

VETERINARY RESEARCH

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chicken onto the glass plate. One drop of the *Mycoplasma synoviae* antigen is then added to the serum. This mixture is thoroughly stirred and gently rotated on the plate for 3 minutes. The agglutination is then read. A clumping of serum and antigen occurs if the chicken has had infectious synovitis for five days or longer

This same test procedure is applied effectively to other diseases such as chronic respiratory disease and pullorum.

new publications

Bulletins

486T. A. D. Longhouse, G. O. Bressler, C. S. Shaffner, and H. L. Garver. Poultry Housing. Basic Data Useful for Design Purposes in the Northeastern States. June 1963.

489. Everett M. Jencks, John T. Raese, Charles D. Reese. Organic Phosphorus Content of Some West Virginia Soils. April 1964.

490. Science Serves Your Farm and Home. Annual Report of A. H. VanLandingham, Director. April 1964.

491. R. W. Pease. Ornamentals—Consumer Response to: 1. Distribution of Literature 2. A Free Landscape Sketching Service. May 1964.

492. K. L. Carvell. Improvement Cuttings in Immature Hardwood Stands— Yield Income While Increasing Future Sawtimber Values. May 1964.

493T. R. A. Phillips. A Low-Cost Hydraulic Cylinder. May 1964.

494. Science Services Your Farm and Home. Annual Report of A. H. VanLandingham, Director. June 1964.

495. A. L. Barr, J. A. Welch, John Rosenberger, and B. W. Wamsley, Jr. Sheep Production—Costs and Returns in West Virginia. June 1964.

Miscellaneous Publications

M. W. Johnson. Hybrid Corn Performance Trials in West Virginia, 1963. February 1964.

A. P. Dye. Construction of Concrete Greenhouse Benches. April 1964.

WEST RUN CREEK was at one time a beautiful stream which provided the water needed by the farm animals and wildlife that came to its banks. Now it is heavily polluted with mine drainage and is rejected by both man and beast.

Acid Mine Drainage

AND THE ACCEPTABILITY OF WATER BY SHEEP

G. C. Anderson, Mark Krosney, H. A. Wilson*

THE THIRST of man's modern civilization seems unquenchable. Water requirements of homes, industries, and agriculture seem to be beyond satisfaction. With increasing demands for water has come the realization that our supply of water is not inexhaustable, that a real and serious shortage can exist, and that we must conserve this vital resource.

Pollution control is receiving an increasing amount of well-deserved attention. There are many types of pollution. Of particular interest to West Virginia is the pollution resulting from mine drainage.

Streams polluted with mine drainage can become useless for recreational purposes and for human consumption. They also can be severely limited in their value for industrial and agricultural purposes.

The amount of food an animal will eat, the kind it will eat, and where it will obtain it can be markedly influenced by the location of the water supply and the amount of water available. Animals obtain water from three sources: water which is contained in the feed, water which is made available during the processes of using nutrients in the tissues (metabolic water), and water which is consumed. With most of our animals, the consumed water, or that part which is drunk, is of particular importance since animal performance is so closely related to it. Where an animal will graze, how much it will eat, how fast it will gain in weight, or how much milk it will produce can be determined by the amount and location of water available to it, and streams often provide this most important supply of water.

When such streams become polluted what is the effect upon the performance of these animals?

In order to determine the effect of pollution on the performance of animals, a study was made of the acceptability of acid mine drainage water for sheep. The polluted water was obtained from West Run Creek on June 25 and July 6, 1963. It was dipped from the creek and stored under refrigeration in 13-gallon plastic carboys until ready for use.

Ten crossbred wether sheep weighing about 75 pounds each were used in the study. They were kept in individual cages so that the amount of food and water they consumed could be measured. During the first eight days, the sheep were allowed to become adjusted to the cages and were fed a ration of pelleted alfalfa. During this time, a uniform intake of one and one-half pounds of alfalfa pellets per sheep per day was established.

At the end of this eight-day period, the sheep were divided into three groups. The first group, composed of four sheep, was offered unpolluted water ("pure"), the second group of three sheep was given polluted water diluted by one-half with "pure" water (slightly polluted water), and the third group of three sheep was offered polluted water (polluted). (The acidity, iron, and sulphate charateristics are given in Table 1).

The sheep were offered one and one-half pounds of pelleted alfalfa in two equal daily feedings, and water was offered before and after each feeding. The amount of hay and water consumed at each feeding was recorded. Between feedings each sheep's water bucket was cover-

(continued on page 6)

*G. C. Anderson is Animal Husbandman; Mark Krosney was a participant in the 1963 Life Sciences Institute; H. A. Wilson is Station Bacteriologist.

W. W. Armentrout

DR. Walter Wardlaw Armentrout was born January 22, 1894, in Washington College, Tennessee, and died in Morgantown, West Virginia, on May 17, 1964.

He is survived by his wife, Dorothy Gasch Armentrout; one son, Dr. Steven Armentrout, Rockville, Maryland; and one daughter, Mrs. Thomas (Sally) Waddle Jr., North Madison, Ohio.

After attending Washington College Prep School, Dr. Armentrout entered the University of Tennessee in 1912, and earned a degree of Bachelor of Science in Agriculture in 1916. In 1925 he received the degree of Master of Science in Agricultural Economics from the University of Wisconsin, and six years later, he was awarded his Doctor of Philosophy degree from the University of Minnesota.

Dr. Armentrout first joined the West Virginia University faculty in 1924. In 1936 he was appointed professor and chairman of the Department of Farm Economics, which later became the Department of Agricultural Economics and Rural Sociology, College of Agriculture, Forestry, and Home Economics. He also served as Agricultural Economist of the West Virginia University Agricultural Experiment Station.

During World War II, Dr. Armentrout was on leave from the University and served as the Morgantown area rent director for the Office of Price Administration. Later in the war, he served in London, England, as a member of the United States Relief Administration.

Dr. Armentrout was the author of numerous journal articles and bulletins of the Agricultural Experiment Station. Some of his most recent publications include: *Some Effects of Price and Income Support Programs on Marginal Farms,* Bulletin 451; *Food Buying—Knowledge—Concerns—Practices, An Evaluation of the Marketing Information for Consumers' Program in the Wheeling-Steubenville Area,* Bulletin 456; and *Tobacco and Marketing in West Virginia,* Bulletin 465.

Dr. Armentrout was a member of the Wesley Methodist Church, the Morgantown Rotary Club, the American Farm Economic Association, Alpha Zeta and Gamma Sigma Delta (honor societies of agriculture), and American Legion.

ACID MINE DRAINAGE

(continued from page 5)

ed and kept under refrigeration at 36 to 38° F. The results of this trial are given in Table 2.

The sheep offered the pure water ate the alfalfa pellets with relish and consumed an expected amount of water. At first the sheep that were offered the slightly polluted water refused to eat or drink. But within a few days, their objection to the water began to decrease, so that by the end of the experiment they were eating and drinking as much as the lambs receiving pure water. The polluted water was unacceptable to the sheep and they would drink only a small amount. The voluntary restriction in water consumption was accompanied by a restriction in food intake.

In this experiment, the sheep exhibited some willingness to adjust to slight levels of iron and sulphate pollution, but at high levels only a limited adjustment took place and the animals preferred to voluntarily restrict food and water intake. The evidence collected in this short experiment clearly indicates that pollution of streams with acid mine drainage can result in a voluntary restriction in water and food intake. This results in lower productivity of the animals that rely upon such sources as streams and other natural flowing water.

Availability of water also has a great influence on the grazing habits of cows, sheep, and deer. When the availability of water is restricted, those areas near acceptable water are likely to be overgrazed, whereas those farther away or without a supply of water will be undergrazed. The effect of either condition upon animals, plants, and soil is not in keeping with the best uses of our resources or in the best interests of the people who rely upon them for a livelihood or recreation.

Water is a precious resource worthy of our care and conservation, not our disrespect and exploitation.

TABLE 1. CHARACTERISTICS OF WATER

WATER DESCRIPTION	pH	IRON			SULFATES
		FERROUS PPM	FERRIC PPM	TOTAL PPM	PPM
Unpolluted water ...	6.40	0.00	0.07	0.07	1
Polluted water	2.45	0.38	1.81	2.19	26
50% Unpolluted and 50% Polluted	2.70	0.17	1.83	2.00	18

TABLE 2

TYPE OF WATER	NO. SHEEP	AVERAGE INTAKE		AVERAGE DAILY URINE		AVERAGE DAILY FECES	
		FEED	WATER	VOLUME	SPECIFIC GRAVITY	WEIGHT	DRY MATTER
		lbs.	*ml.*	*ml.*		*gms.*	*%*
Unpolluted	4	1.5	3808	934	1.071	1263	36.5
Polluted	3	1.05	632	287	1.074	307	50.0
50% Unpolluted and 50% Polluted	3	1.4	3397	958	1.070	1151	38.0

WHAT'S IN A BULL PROOF?

R. G. Mitchell, Associate Dairy Scientist

SINCE the inclusion of progeny testing in dairy cattle breeding, a number of methods have been utilized in an attempt to estimate an animal's genetic worth. Two of the most widely used methods of sire evaluation have been the daughter average and the daughter-dam comparison. More recently the herdmate or stablemate comparison has been used.

The daughter average is nothing more than an arithmetic average of the production of a bull's daughters. It considers neither the productive level of the cows with which the bull was mated nor does it allow for differences attributable to feeding and management practices in different herds. As a consequence, the daughter average of a bull mated to a number of high producing females may appear quite outstanding although he may actually be an average or a below average bull genetically. In addition, the daughters of one bull may make their records in a herd where average or below average feeding and management practices are utilized, whereas the daughters of another bull may be in a herd where outstanding feeding and management practices are used. It would be folly to evaluate these two progeny groups strictly on the basis of a daughter average.

In an attempt to strengthen the evaluation process of a bull, the daughter-dam comparison gained widespread usage. It did compare the daughters of a bull with their dams. It would appear that if the daughters produced more than their dams then the bull was capable of consistently transmitting genetic material for high production. Conversely, if the daughters produced less than their dams, it followed that the bull was consistently transmitting genetic material for low production. The fallacy in this thinking is centered around the fact that feeding and management were ignored in the evaluation. Little consideration was given to the changes that were consistently taking place in improved pastures and forages, higher concentrate feeding, and better management practices. Allow me to expand on the previous statement in the following manner. A normal gestation takes approximately nine months. Assuming you are following the practice of calving your heifers at two years of age and they lactate for 305 days, this adds another thirty-four months for a total of forty-three months. This is approximately a period of three and one-half years from the time the animal was conceived. Since first records of both daughter and dam are used in a daughter-dam comparison, there would be a minimum of three and one-half to four years between the time a dam and daughter made their records. During this period, the feeding and management practices may have been altered, and although we are attempting to evaluate a bull from a genetic standpoint, any increase or decrease may be solely due to changes in environment.

Table 1 shows an actual situation taken from the West Virginia University dairy herd. An Ayrshire bull sired ten daughters that completed 305-day production records. All records were based on twice-a-day milking and adjusted to a mature equivalent basis.

The daughter level in itself is quite high when comparing it to the national breed average. If we limited our evaluation to the daughter-dam comparison, we would be impressed with the substantial increase of the daughters over the dams. However, in the spring before the birth of this bull's offspring, a new feeding regime was initiated. Prior to this date, no animal was allowed more than fifteen pounds of concentrates a day. Since that time we have been utilizing the "lead feeding" concept where an animal is fed up to her ability to respond with more milk for each pound increase in concentrates. Some animals are now receiving thirty or more pounds of grain per day, depending upon their daily production, twice the amount of concentrates the dams of these animals were receiving.

For several years the terms herdmate or stablemate comparisons have been coming into prominence. It makes little difference which term is used—they are essentially the same. The basic consideration for this method of evaluation consists of how a given animal performs in relation to the other animals in the herd during the same period of time—usually during the herd test year. Each animal is evaluated in terms of plus (+) or minus (—) so many pounds of milk and milk fat from the herd average. All records must be standardized to a common basis of comparison. This is usually twice-a-day milking, 305-day, mature equivalent basis. Research at West Virginia Agricultural Experiment Station and at other experiment stations has demonstrated that a bull can best be evaluated on this stablemate comparison.

If we evaluate the Ayrshire bull previously mentioned from a stablemate comparison basis, we find that his ten daughters averaged 652 pounds of milk and three pounds of milk fat below the herd average. He was mated to cows that were herd average. His butterfat test was 0.24 per cent above the herd average. We are now able to conclude that this bull was mated to average cows and sired daughters that were below average for milk production but above average for per cent fat test. If we are interested in increasing the genetic potential for high milk production in our herd, then we should not use this bull again regardless of what the daughter-dam comparison indicates.

At the present time the Animal Research Branch of the U. S. Department of Agriculture is publishing quarterly a Sire Summary List containing all bulls for all of the major dairy breeds having production-tested daughters. These bulls are evaluated by the stablemate comparison method. These Sire Summary Lists are available to all county agents and D.H.I.A. supervisors. Use the plus (+) bulls listed in this summary. It is the best way now known for increasing the genetic potential for high production in your herd. It works here in the University dairy herd—we are certain it will work for you.

TABLE 1

	LBS. MILK	PER CENT FAT	LBS. FAT
10 daughters averaged	11,782	4.34	512
10 dams averaged	10,617	4.05	430
Daughters superiority over dams	+1,165	+.29	+82

Profitable Layers

H. M. Hyre, Associate Poultry Geneticist

ALTHOUGH many factors influence profit of a commercial egg production enterprise, the number of eggs laid per hen is perhaps the most important. Unless the hens are laying at a high rate, it will be almost impossible to make a satisfactory return from the business. Egg production is influenced by inheritance and environment. However, environment will have little effect on this trait unless the hen has first inherited the ability to lay at a high rate.

The West Virginia University Agricultural Experiment Station has been studying the influence of various types of cross breeding on egg production. These studies show that the crossing of unrelated chickens will increase egg production. The two principal types of crosses made were of crossing two different strains of the same breed and the crossing of different breeds. In Table 1 the production results of six different crosses made from four different purebred strains may be noted. The purebred strains used were two unrelated strains of Single Comb White Leghorns, one strain of a meat type New Hampshire, and one strain of a good egg production Rhode Island Red. Every possible cross from these four strains was made. Results listed in Table 1 show that in every case the egg production from the cross progeny was even greater than that of the highest producing purebred strain used in the particular cross. This trend has prevailed in this study for the past three years and is in agreement with similar studies as well as observations from commercial flocks.

While there are many high producing purebred strains, most commercial egg production flocks today are some kind of a cross. As has already been pointed out, in general, crosses will lay at a higher rate than their purebred parents and the number of eggs produced per hen has been said to be the most important factor in determining income. A good goal to strive for would be to market 20 dozen of eggs per year from every pullet housed. The first step in obtaining high egg production would be to start with birds that have the ability to lay at a high rate. There are many such strains available to the egg producers. A list of the top poultry breeders may be found in the Report of Egg P[illegible]ductions Tests. This is a recor[illegible] stock entered in performance [illegible] in the United States and Can[illegible]. Such information on egg producti[illegible] egg size, feed required per dozen o[illegible] eggs, body weight, interior egg quality and shell thickness of the various strains may be obtained from this report. A copy of this report is available from the local Cooperative Extension Agents' offices or by writing to the Extension Poultryman, College of Agriculture, West Virginia University, Morgantown.

TABLE 1. PER CENT EGG PRODUCTION ON A HEN-DAY BASIS OF THE PUREBRED PARENTS AND CROSS PROGENY

PUREBRED PARENTS	PER CENT PRODUCTION
Purebred Parents	
Leghorn 1	54.33
Leghorn 2	63.63
New Hampshire	45.43
Rhode Island Red	54.78
Cross Progeny	
Leghorn 1 X Leghorn 2	70.76
Leghorn 1 X New Hampshire	62.43
Leghorn 1 X Rhode Island Red	65.31
Leghorn 2 X New Hampshire	64.78
Leghorn 2 X Rhode Island Red	75.12
New Hampshire X Rhode Island Red	67.33

Robert S. Dunbar, Jr. New College Dean

DR. Robert S. Dunbar, Jr. is the new dean of the College of Agriculture, Forestry, and Home Economics at West Virginia University.

Dr. Dunbar, the former chairman of the Department of Animal Industry and Veterinary Science, assumed the deanship on May 1. He fills the vacancy created when Dr. E. J. Nesius left the position to become vice-president—West Virginia Center for Appalachian Studies and Development in March, 1963. J. O. Knapp was the Acting Dean of the College since that time.

Dr. Dunbar is a native of Rhode Island. During military service in World War II, Dr. Dunbar received college work in basic engineering. He entered the University of Rhode Island College of Agriculture after the war and earned a B.S. degree in 1949. Dr. Dunbar went on to complete graduate work at Cornell University, where he received an M.S. degree in 1950, and a Ph.D. in animal breeding in 1952. He joined the staff of the Dairy Department at West Virginia University in 1952, where he taught and did research in dairy cattle breeding. From 1957 to 1962 he served as Station Statistician, and served on a regional committee on genetics in connection with a poultry breeding project. When the new Department of Animal Industry and Veterinary Science was established on January 1, 1963, Dr. Dunbar assumed the responsibilities of department chairman.

He is a member of Gamma Sigma Delta, the American Society of Animal Science, and the Biometric Society.

DR. DUNBAR